CLAIMS

We claim:

1. A hyperbaric oxygen therapy system comprising:

a pressure vessel containing a gas, the vessel being capable of accommodating a patient;

an oxygen concentration measurement apparatus for monitoring a concentration of oxygen in the gas;

an environmental control apparatus for controlling the temperature of the gas in the vessel; and

a pressure/ventilation control apparatus for controlling the pressure of the gas in the vessel.

2. The hyperbaric oxygen therapy system of claim 1, wherein the oxygen concentration measurement apparatus comprises:

an oxygen concentration analyzer providing an output representative of the concentration of oxygen in the gas;

a plurality of gas lines connecting the oxygen analyzer to the pressure vessel for conducting the gas from an interior of the pressure vessel to the oxygen analyzer, each gas line having a port in a separate location of a wall of the pressure vessel for receiving the gas in the pressure vessel;

a sample valve located in each gas line for opening and closing the port; and

a controller for actuating the sample valve to open and close the port according to a predetermined schedule.

3. The hyperbaric oxygen therapy system of claim 2, wherein the oxygen sensing apparatus further comprises:

a vent valve in fluid communication with the oxygen analyzer for venting the gas from the analyzer subsequent to closing each sample valve.

4. The hyperbaric oxygen therapy system of claim 1, wherein the environmental control apparatus comprises:

a scrubber, a heat exchanger and a blower located within the pressure vessel, each of which is in fluid communication with the gas;

a heat pump in fluid communication with the heat exchanger by a conduit having an exchange fluid therein;

a temperature sensor in fluid communication with the gas in the vessel which provides an output representative of a temperature of the gas; and

a temperature controller having an adjustable set point which receives the output of the temperature sensor and provides a control signal to the heat pump for adjusting the temperature of the exchange fluid to thereby maintain the temperature of the gas within a predetermined range of the set point.

5. The hyperbaric oxygen therapy system of claim 1, wherein the pressure/ventilation control apparatus comprises:

a pressure controlling valve for regulating a flow of pressurized gas into the pressure vessel;

a pressure sensor in fluid communication with the gas in the pressurized vessel that outputs a signal representative of a pressure of the gas within the pressure vessel;

a ventilation valve that regulates a gas flow out of the pressure vessel; and

a controller having a programmable pressure profile, the controller controlling the pressure controlling valve to maintain a pressure of the gas in the pressurized vessel to within a predetermined range around the programmed pressure profile and controlling the

ventilation valve to adjust the ventilation flow rate according to the pressure profile.

6. The hyperbaric oxygen therapy system of claim 1, further comprising a gas compressor, the compressor including an intake, an outtake, and at least one silencer connected to at least one of the intake and the outtake.

7. The hyperbaric oxygen therapy system of claim 6, further comprising a porous packing material located within the at least one silencer and filling at least part of the interior volume of the at least one silencer.

8. The hyperbaric oxygen therapy system of claim 6, wherein a first at least one silencer is connected to the intake and a second at least one silencer is connected to the outtake.

9. The hyperbaric oxygen therapy system of claim 6, wherein the packing material is formed of high density polyethylene (HPDE) material.

10. A hyperbaric oxygen therapy system having a pressure vessel containing a gas, an oxygen concentration measurement apparatus comprising:

an oxygen analyzer providing an output signal representative of a concentration of oxygen in the gas;

a plurality of gas lines connecting the oxygen sensor to the pressure vessel for conducting the gas from an interior of the pressure vessel to the oxygen analyzer, each gas line having a port in a separate location of a wall of the pressure vessel for receiving the gas in the pressure vessel;

a sample valve located in each gas line for opening and closing the port;

a vent valve in fluid communication with the oxygen analyzer for venting the gas from the analyzer; and

a controller for actuating the sample valve in each gas line to open and close the port in accordance with a predetermined schedule, and to actuate the vent valve subsequent to closing the sample valve in each gas line.

11. The oxygen concentration measurement system of claim 10, further including an alarm for announcing when the measured concentration of oxygen is outside a predetermined range.

12. A hyperbaric oxygen therapy system having a pressure vessel containing a gas and an environmental control apparatus, the environmental control apparatus comprising:

a scrubber, a heat exchanger and a blower located within the pressure vessel, each of which is in fluid communication with the gas;

a heat pump external to the pressure chamber, in fluid communication with the heat exchanger by a conduit having an exchange fluid therein;

a temperature sensor in fluid communication with the gas in the vessel which provides an output representative of a temperature of the gas; and

a temperature controller having an adjustable set point which receives the output of the temperature sensor and provides a control signal to the heat pump for adjusting the temperature of the exchange fluid to thereby maintain the temperature of the gas within a predetermined range of the set point.

13. The hyperbaric oxygen therapy system of claim 12, wherein the scrubber contains a carbon dioxide adsorbing packing material for removing carbon dioxide from the gas.

14. The hyperbaric oxygen therapy system of claim 12, wherein the blower is an injection blower.

15. The hyperbaric oxygen therapy system of claim 14, wherein the blower operates by receiving gas from a source of pressurized gas.

16. A hyperbaric oxygen therapy system having a pressure vessel containing a gas, a pressurizing compressor and a pressure/ventilation control apparatus, the pressure/ventilation control apparatus comprising:

a pressure controlling valve connected between the compressor and the pressure vessel for controlling a gas flow from the compressor into the pressure vessel;

first and second ventilation valves connected to the pressure vessel for controlling a gas flow out of the pressure vessel;

a pressure sensor for sensing a pressure of the gas within the pressure vessel and providing a pressure signal representative of the gas pressure; and

a controller having a programmable pressure profile, the controller receiving the pressure signal and controlling the pressure control valve to maintain a pressure of the gas in the pressurized vessel within a predetermined range around the programmed pressure profile, and controlling the first and second ventilation valves in accordance with the pressure profile.

17. The hyperbaric oxygen therapy system of claim 16, wherein the first valve is actuated to vent the vessel when the pressure in the vessel is decreasing and the second valve is actuated to vent the vessel when the pressure is substantially steady.

18. The hyperbaric oxygen therapy system of claim 17, further including an adjustable flow regulator connected to the second valve, wherein a venting flow rate is regulated according to an adjustment of the adjustable flow regulator when the second valve is actuated.

19. The hyperbaric oxygen therapy system of claim 16, wherein the pressure profile includes at least a first pressure set point, a second pressure set point, a time rate of change of increasing pressure from the second pressure set point to the first pressure set point, a soak-time at the first pressure where the pressure is substantially steady and a rate of change of decreasing pressure from the first pressure set point to the second pressure set point.

20. A method for performing hyperbaric oxygen therapy in a pressurized vessel containing a gas comprising the steps of:

setting a pressure profile;

setting a treatment temperature of the gas in the pressure vessel;

setting a first ventilation rate;

performing a treatment cycle in accordance with the pressure profile wherein the pressure is first changed from a first pressure to a second pressure, after which the pressure of the gas is maintained at a substantially steady pressure during which time the gas in the vessel is vented from the vessel at the first ventilation rate, after which the pressure of the gas is decreased and the gas in the vessel is vented at a second rate and wherein during the treatment cycle, the oxygen concentration in the vessel is monitored at a plurality of locations, carbon dioxide is removed from the gas and the temperature of the gas is maintained at the treatment temperature.

21. A compressor including an intake, an outtake, and at least one compressor silencer connected to at least one of the intake and the outtake, the compressor silencer comprising:

a silencer housing including an elongate body having an inlet end and an outlet end;

an inlet cap secured to the inlet end of the body;

an outlet cap secured to the outlet end of the body; and

a porous packing material that reduces noise created by the compressor, the packing material located within the elongate body and filling at least part of the volume between the inlet end and the outlet end of the body, said packing material being supported by the inlet cap and the outlet cap.

22. The hyperbaric oxygen therapy system of claim 21, wherein a first at least one silencer is connected to the intake and a second at least one silencer is connected to the outtake.

23. The hyperbaric oxygen therapy system of claim 21, further comprising at least two elongate support rods mounted within the elongate body and extending between the inlet end and the outlet end of the body.

24. The hyperbaric oxygen therapy system of claim 21, wherein the packing material of the silencer is formed of high density polyethylene (HPDE) material.

25. A safety mechanism for an airlock providing access to a pressure vessel, the airlock having an exterior door mounted in an exterior door frame, an interior door mounted in an interior door frame and a transfer chamber connecting the exterior door frame and the interior door frame, the safety mechanism comprising:

a first selector located in the exterior door frame moveable between a first position and a second position; and

a second selector located in the exterior door frame, and moveable from a first position to a second position only when the first selector is in the second position and wherein the first selector is moveable from the second position to the first position only when the second selector is in the first position.

26. The safety mechanism of claim 25, further comprising a door lock cylinder in the exterior door frame connected to the first selector, the first selector actuating the

door lock cylinder into a locking position to lock the exterior door to the exterior door frame when the first selector is in the second position.

27. The safety mechanism of claim 25, further comprising a an O-ring between a periphery of the exterior door and the exterior door frame, the first selector causing the O-ring to be pressurized when the first selector is in the second position thereby sealing the exterior door to the exterior door frame.

28. The safety mechanism of claim 25, further comprising a vent valve connected to the second selector, the vent valve providing fluid communication between an interior of the chamber and atmosphere when the vent valve is in the first position and preventing fluid communication between the interior of the chamber and the atmosphere only when the second selector is in the second position.

29. The safety mechanism of claim 25, further comprising a third selector moveable from a first position and a second position only when the second selector is in the second position of the second selector and wherein the second selector is moveable from the second position to the first position only when the third selector is in the first position.

30. The safety mechanism of claim 29, further comprising an interior pressure valve connected to the third selector, the interior pressure valve providing fluid communication between the interior of the chamber and an interior of the pressure vessel only when the third selector is in the second position and preventing fluid communication between the interior of the chamber and the interior of the pressure vessel when the third selector is in the first position.

31. The hyperbaric oxygen therapy system of claim 29, wherein the second selector is a rotatable knob having a cammed outer surface for cooperatively engaging the third selector.

32. The hyperbaric oxygen therapy system of claim 25, wherein the first selector is a rotatable knob having a cammed outer surface for cooperatively engaging the second selector.

33. A method for enabling transfer of an object from an interior of an airlock to a pressure vessel attached to the airlock and ensuring that an exterior door of the airlock cannot be opened when the interior of the airlock is pressurized, comprising the steps of:

actuating a first selector from a first position to a second position whereby the first selector causes the exterior door to be locked and sealed;

thereafter actuating a second selector from a first position to a second position thereby closing a vent from the interior of the airlock to the atmosphere; and

thereafter actuating a third selector from a first position to a second position thereby opening a vent between the interior of the airlock and the pressure vessel thereby enabling a door between the interior of the pressure vessel and the interior of the airlock to be opened.

34. A method for enabling transfer of an object from an interior of an airlock attached to a pressure vessel to the atmosphere and ensuring that an exterior door of the airlock opening to the atmosphere cannot be opened when the interior of the airlock is pressurized, comprising the steps of:

closing a door between the interior of the airlock and the pressure vessel;

thereafter actuating a third selector from a second position to a first position thereby closing a vent between the interior of the airlock and the pressure vessel;

thereafter actuating a second selector from a second position to a first position thereby opening a vent from the interior of the airlock to the atmosphere; and

thereafter actuating a first selector from a second position to a first position whereby the first selector causes the exterior door to be unlocked and unsealed.